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FISHES WITH TWO MOUTHS

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INTRODUCTION

Malformations of the mouths of fishes, while rather unusual, are not unknown. These range from pug-headedness (in which, because of the absence of the upper jaw, the open buccal cavity looks like the entrance to a cave) through partial to complete buccal occlusion. In the latter case feeding as well as breathing takes place through the branchial apertures. However, probably the rarest of all mouth malformations is that in which two functional mouths are present. Four cases of this are recorded in the literature, and a specimen (a fifth case) of such a fish lies before me. Under the circumstances it seems well to describe the fish and to bring together the accounts in the literature as a background.

A TWO-MOUTHED YELLOW PERCH, *PERCA FLAVESCENS*

The Erie (Pennsylvania) Public Museum issues a popular little journal called The Broadcaster to keep its members and friends in touch with its activities. My attention was recently called to a statement in the issue of June 1, 1930, that the Museum possessed a perch having two mouths. A letter to the Director, Mrs. Katharine B. Blake, brought the fish and all the available information about it. It is a pleasure to acknowledge this courteous response to my request for the loan of this unusual specimen.

This fish, hooked in the lower mouth, was taken on July 2, 1914, from the pier of the Life Saving Station situated on Presque Isle, at the mouth of Erie Harbor, Lake Erie.

This specimen is a fresh-water perch, *Perca flavescens*, measuring 174 mm. in total and 146 in standard length. It has been eviscerated and after long immersion in alcohol has a girth of 95 mm. and a weight of only 23.5 grams. The vertical gape of the mouth proper is 13 mm., the horizontal stretch across the mouth from angle to angle is 11 mm. The second mouth (?) has a vertical gape of 22 mm. and a horizontal stretch of 11 mm. Both these mouths open into the gullet.

The fish is shown in lateral view slightly reduced (to 120 mm. over all) in Fig. 1. Here one sees the morphological mouth as an entirely

normal structure, while below it is the enormous opening, the second mouth. In Fig. 2 are portrayed the mouth-parts in anterior view, and in Fig. 3 the same in oblique (quartering) view. In both these figures one sees how much larger the lower mouth is than the upper and true one. In this lower mouth may be seen the tongue bone and the attached gill-arches.

The fish then has two functional mouths. Inspection of these showed that apparently a certain amount of functional activity of the upper jaw was possible, but that the lower part of the second mouth was immovably fixed. Prehension then could be effected only by the closure of the jaws of the morphological mouth, but undoubtedly food could also enter by the lower opening—drawn in by the sucking action of the opening gill-covers. One cannot say if there was at the same time any movement of the floor of the second mouth to help ingestion. This seems doubtful. That the lower mouth is functional for feeding is clear when it is remembered that the fish was hooked in this opening.

The explanation of this curious lower structure is not far to seek. The whole floor of the mouth, the hyoid region, has been torn away from the jaws and by contraction of the branchial muscles has been pulled backward and downward into the present position. In fact the sheet of tissue lying between the jaws and the hyoid apparatus has been drawn backward around the projecting central gill-arch apparatus in a cloak-like fold (Fig. 1). Healing has taken place perfectly, and there is no sign of infection or sloughing of the tissues.

At the time this interesting specimen came to me, there was in the literature known to me but one account of such a deformity. However, since then three other accounts have been found. These will now be taken up in chronological order, that all the known accounts may be brought together and considered here.

A BIB OR POUT, *GADUS LUSCUS*, WITH TWO MOUTHS

My interest in fishes with two mouths was first aroused by the picture and description of the fish shown in Fig. 4. This was sent to me by Mr. R. L. Marston, editor of the Fishing Gazette (London), for whose courtesy I am greatly obliged. The account itself is a brief one contributed by Mr. Percy Wadham (1926), the well known sportsman of the Isle of Wight. He says:

> Unfortunately, I did not see it in the flesh, but it appears in the photograph as though the lower mouth is properly formed with teeth and tongue complete, and I understand it was hooked in the lower jaw by an angler fishing off Cowes, I. W. . . .

I do not know the weight of the fish, . . . but doubt if it was much over half a pound, as this species runs pretty small in the Solent.

Inspection of Fig. 4, in which the head is in sharp focus, shows, here, a precisely similar state of affairs as that described for the yellow perch above. The whole hyoid with the attached parts has been torn from the lower jaw, and there has thus been formed a gaping functional lower mouth. What Mr. Wadham took for jaws and teeth are the gill-arches and gill-rakers, and for the tongue, the basihyal. The true mouth can be closed, but this lower mouth gapes continually.

A TWO-MOUTHED TROUT (*SALMO FARIO?*)

The only specimen of a two-mouthed fish known in the literature at the time when the Erie specimen came to me refers to such a deformed "laxoring" (trout) described by Lönnberg, in 1917.

Lönnberg does not give the size of his fish, which he did not collect himself, and of which the head only came to him. The fish was taken by hook and line in July, 1916, in Storum, Sweden. He remarks upon the significance of the fact that it was hooked in the lower mouth as indicative of the fact that the fish fed through this abnormal mouth. He notes that the lower jaw of the real mouth is entirely normal and that the edges of the tissues on the lower side of the jaw and on the free edges of the hyoid parts are as sharply defined as if they had been cut with a knife. He thinks that this injury must have been inflicted long before the specimen came to him because of the absence of any scar tissue or sign of mechanical injury, but much more because the inner edges of the skin, the tongue and the anterior parts of the attached gill-arches are "strongly pigmented." This, of course, indicates that these parts had been long exposed to the light. Evidently this fish went about with its lower "mouth" open and exposed to the sun's rays. No such pigmentation was found in the true mouth which was evidently normally more or less closed. None was visible in the second mouth of the Erie specimen, as may be seen by reference to Fig. 2. However, had there ever been such, it would have been bleached out during the long sojourn (sixteen years) of the fish in alcohol.

With regard to the formation of this secondary aperture, Lönnberg thinks the edges too smooth and the parts too symmetrical to have resulted from a tear by a hook caught in the outer throat-parts. He is inclined to believe that some slight mechanical injury to the tissues between the jaw and the first gill-arch may have been accentuated by the prehension of prey resulting in a further tearing of the membrane and displacement of the hyoid parts.

Lönnberg published an excellent figure (Fig. 5 herein), in which the lower mouth (indicated by the arrow) is of enormous size due to the tremendous downward displacement of the hyoid parts. The floor of this second mouth is quite densely pigmented as recorded.

A GRAYLING, *THYMALLUS VULGARIS*, WITH TWO MOUTHS

The interest excited by Lönnberg's article led to the republication on the pages immediately following it in the Swedish journal of a forgotten note on the same subject by Ivar Arwidsson (1909, 1917). This had appeared eight years previously in the same journal, but as the title had never gotten into any known bibliography, it had been completely overlooked. In the literature cited at the end of this paper it is listed from both issues of the journal.

The head of Arwidsson's specimen is shown herein as Fig. 6. It portrays an exactly similar malformation of the lower jaw as have the other fishes. Here, also, the hyoid apparatus had been detached from the lower jaw, but the tissues had healed perfectly and the new mouth was entirely bilateral. The author had no conjecture to make as to the origin of the injury. The fish was taken in a net in Jämtland, Sweden, in September, 1907. Arwidsson significantly notes that it was a lean fish and concludes that this was a consequence of starvation brought about by the injury it had suffered.

In Fig. 7 this head is shown in front-ventral view. Printed very dark on soft paper this figure has necessarily been poorly reproduced, but it is included that an idea may be had of the size and shape of the aperture left by the violent dislocation of the floor of the mouth.

AN ANGLER, *LOPHIUS PISCATORIUS*, WITH A SUPPLEMENTARY MOUTH

The sole remaining account, and the earliest known to me, dates back to 1810. In this year, A. Risso published his first book on the fishes of Nice, and in this he describes a "baudroie," the European angler, in the following terms:

> A monstrous specimen of this species, taken in March, 1806, at Villefranche, had an enormous head but one with two very large mouths placed one above and the other below. Both were provided with five rows of sharp teeth. They were united behind in a throat bristling with teeth. The two throats belong to one and the same body.

The same description in almost the same words is given in Risso's larger work published sixteen years later (1826) in five volumes. Too much credit cannot be given Risso for this observation, which is but one

of many keen natural-history notes on the many interesting things about the structures and habits of fishes to be found in his book.

That he was in error does not militate against the above statement. There is every reason to believe that this fish had suffered the identical injury described above, that the whole hyoid apparatus had suffered dislocation, and that the five rows of sharp teeth in the lower mouth were really the pharyngeal teeth showing in this lower mouth by reason of the downward dislocation of the whole pharyngeal region. It is greatly to be regretted that Risso did not publish a figure showing this extraordinary teratological specimen.

DOUBLE MONSTER FISH EMBRYOS WITH TWO MOUTHS PLACED LATERALLY

Other than the foregoing, the only two-mouthed fishes known to me are two embryo trouts figured by Gemmill in his great work on malformations in fishes. Furthermore, these are not vertical duplications but lateral ones. These are double monsters with complete union in the head region. In one, the two inner eyes are placed close to each other, and there are "two mouth openings separated by a thick septum containing the adjacent hyomandibular and Meckelian cartilages. . . . The two mouth-openings lead into separate buccal cavities but the oesophagus is single." This specimen is shown in outline drawing in Fig. 8. Gemmill also figures an embryo trout having three eyes: two normal lateral eyes and one intermediate one formed probably by the fusion of the two inner eyes or consisting of the one left following the suppression of the other inner eye. The head of this fish is shown in outline drawing in Fig. 9. Here the two lateral mouths are seen much closer than in the preceding specimen but still separated by the remains of the Meckelian bars.

These figures and descriptions are of fishes having duplicate mouths laterally placed. They add little to our knowledge, for such malformed embryos never survive the end of yolk-sac absorption. Strictly speaking, these two embryos are hardly pertinent to the subject under discussion, but these two paragraphs are introduced to emphasize the fact that there are no records whatever of fishes with two mouths other than those shown herein to be the result of injury rather than of deficiencies arising during development.

RÉSUMÉ

Inspection of the figures of the first four fishes described shows the same identical condition: the hyoid apparatus with attached gill-bars has been forcibly torn away from the mandibles and remains displaced

at some distance from the lower jaw. This gives a functional lower mouth, but one which remains permanently open since it lacks any muscles which would bring it in opposition to the lower and inner edges of the mandibles. One can conceive that such a fish swimming along might automatically engulf quiescent organisms or bits of dead food. Certainly there can be no prehension by this lower mouth, and in fact any food prehended by the upper and lower jaws would, since there is no tongue to work with the jaws, fall into the enlarged buccal cavity and, if active, swim away. Presumably, such a deformed fish must feed mainly by sucking in food by the action of its gill covers.

In this connection it should be noted that three out of the five fishes described were taken on a hook—it is definitely stated that each was hooked in the lower mouth. This would seem to show that this aperture is the one most used in feeding.

This second mouth must be the result of some injury or accident, presumably in adult life, certainly long since hatching.

Whether in a teleost a second and lower morphological mouth could be formed in the embryo is a matter of great doubt. Lateral horizontal duplications in bony fishes are not unknown, as double heads and twin tails (and even mouths in embryos, as shown above) bear witness. But, so far as I know, no dorsiventral doubling of parts is on record. According to Dohrn's theory of the formation of the mouth out of pre-mandibular gill-clefts by coalescence, it seems hard to understand how a second and lower mouth could be formed save by using up a second pair of gill-clefts. There is no evidence that such has taken place in the specimens under consideration. None are lacking in the perch (Fig. 2) and the loose tissue connecting the branchial basket with the lower jaw has curled back and lies blanket-like around the basihyal. Apparently, essentially similar conditions are met with in the other fishes figured and described. Double mouths in fishes are always the result of injury, so far as our present knowledge goes.

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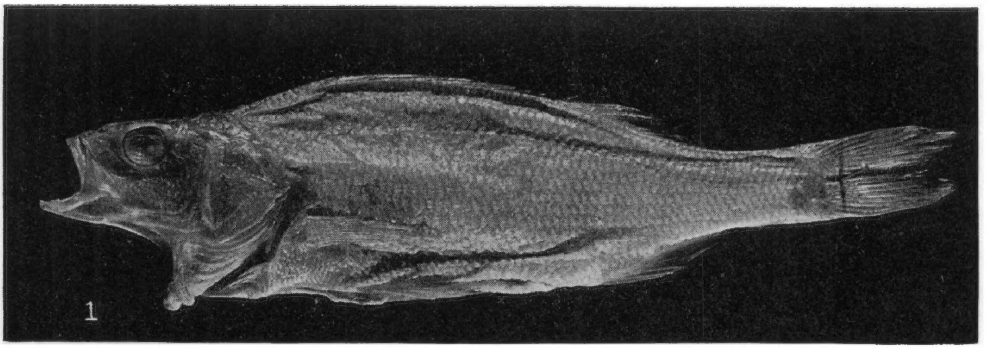
Fig. 1. Lateral view of a 174 mm. yellow perch, *Perca flavescens*, showing two mouths.

Fig. 2. Looking into the two mouths of *Perca flavescens*. Note the gill-arches in the floor of the second mouth.

Fig. 3. Slightly oblique view of the two mouths of the yellow perch.

Fig. 4. Quartering view of a bib (*Gadus luscus*) with two mouths.

After Wadham, 1926.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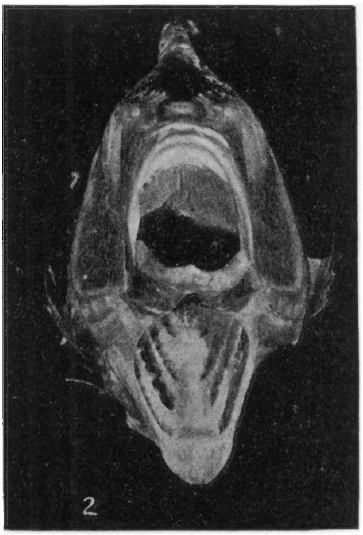
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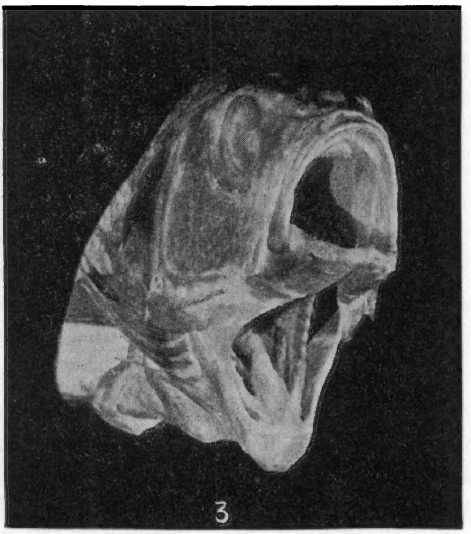
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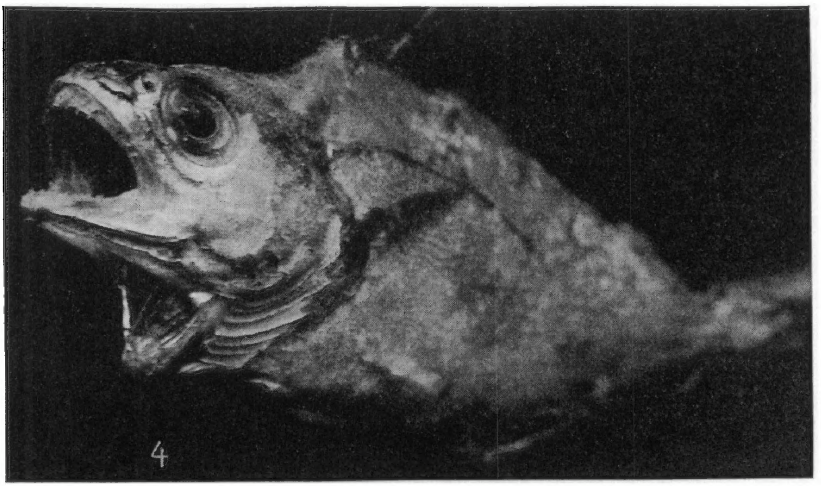
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Fig. 5. An almost lateral view of the head of a trout with two mouths. The arrow points to the second mouth.

After Lönnberg, 1917.

Fig. 6. Profile view of a grayling (*Thymallus vulgaris*) with two mouths.

After Arwidsson, 1909 and 1917.

Fig. 7. Head of grayling seen in front-ventral aspect.

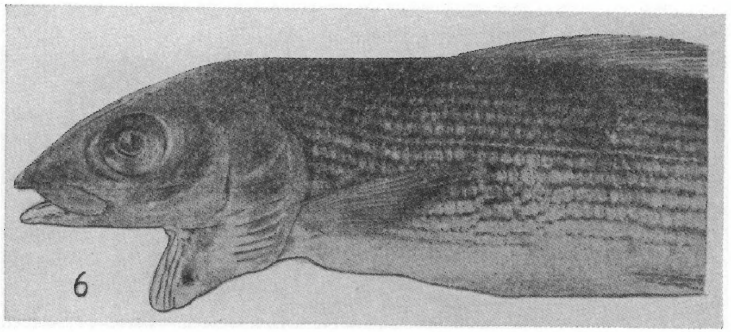
After Arwidsson, 1909 and 1917.

Fig. 8. Double-monster trout embryo having two mouths separated by a wide septum.

After Gemmill, 1912.

Fig. 9. Double monster trout embryo having two mouths separated by a narrow septum. In this fish the fusion is more complete and the embryo less abnormal in general appearance.

After Gemmill, 1912.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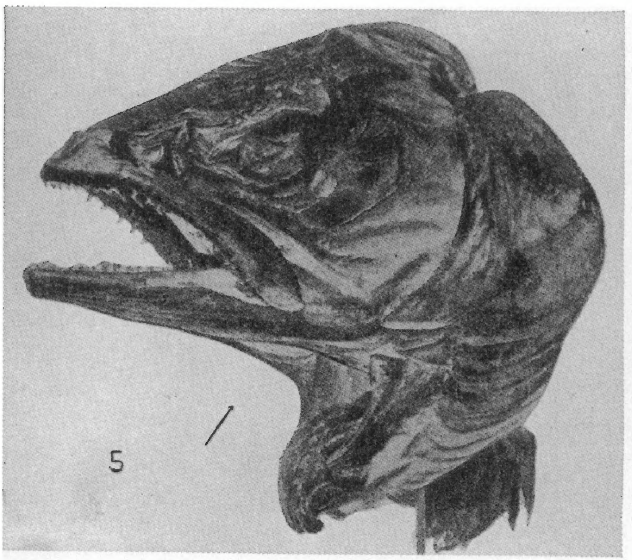
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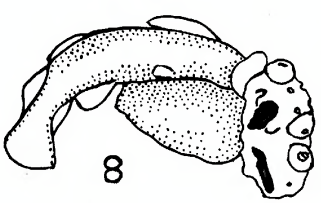
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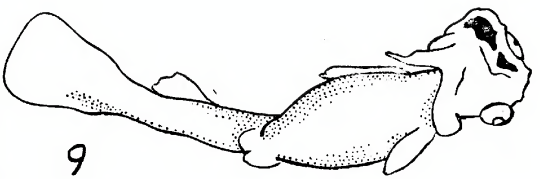
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